PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-351778

(43)Date of publication of application : 21.12.2001

(51)Int.Cl. H05B 33/06
H05B 33/10
H05B 33/14

(21)Application number : 2000-171946

(22)Date of filing : 08.06.2000

(71)Applicant : TOHOKU PIONEER CORP

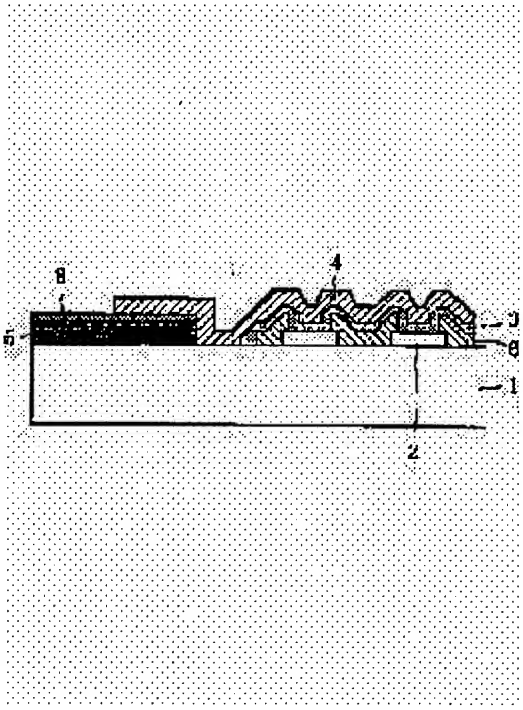
(72)Inventor : SHIRAHATA KUNIHIKO
NAGAYAMA KENICHI

(54) ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE AND ITS MANUFACTURING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an organic electroluminescent display device, capable of preventing generation of an alteration layer 7 causing contact resistance to increase by forming a barrier layer 8 as a surface layer of an extraction electrode 5, and being driven by a comparatively constant voltage.

SOLUTION: In this organic electroluminescence display device, the barrier layer 8 is formed as the surface layer of the extraction electrode 5 installed on a transparent substrate 1. The extraction electrode 5 is brought into contact via the barrier layer 8 with a metal electrode 4 laminated on the transparent substrate 1 via an organic luminescent layer 3. The extraction electrode 5 is formed from metallic conductive material such as Cr, Al, Cu, Ag, Au, Pt, Pd, Ni, Mo, Ta, Ti, W, C, Fe, In, Ag-Mg, Zn or the like. The barrier layer 8 is formed of a metal, having satisfactory heat-resistant alteration property and a high-melting point, a noble metal, an oxide, a nitride, or an oxidized nitride.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than

the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2001－351778
（P2001－351778A）
(43)公開日　平成13年12月21日(2001.12.21)

(51)Int.Cl.'		識別記号	FI		テーマコード'(参考)
H05B	33/06		H05B	33/06	3K007
	33/10			33/10	
	33/14			33/14	A

審査請求　未請求　請求項の数6　ＯＬ　（全５頁）

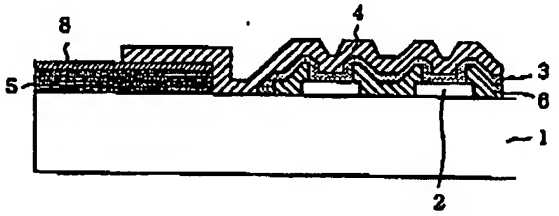
(21)出願番号　特願2000－171946(P2000－171946)
(22)出願日　平成12年６月８日(2000.6.8)

(71)出願人　000221926
東北パイオニア株式会社
山形県天童市大字久野本字日光1105番地
(72)発明者　白幡　邦彦
山形県米沢市八幡原四丁目3146番７号　東北パイオニア株式会社内
(72)発明者　永山　健一
山形県米沢市八幡原四丁目3146番７号　東北パイオニア株式会社内
(74)代理人　100092392
弁理士　小倉　亘

Ｆターム(参考)　3K007 AB06 AB14 AB15 AB18 CA01 CB01 CC05 DA01 DB03 EB00 FA01 FA02

(54)【発明の名称】　有機エレクトロルミネッセンス表示デバイス及びその製造方法

(57)【要約】
【目的】　引出し電極５の表層にバリア層８を形成することにより、接触抵抗を上昇させる変質層７の生成を防止し、比較的定電圧で駆動可能な有機エレクトロルミネッセンス表示デバイスを得る。
【構成】　この有機エレクトロルミネッセンス表示デバイスは、透明基板１に設けられた引出し電極５の表層にバリア層８を形成している。引出し電極５は、有機発光層３を介して透明基板１上に積層された金属電極４にバリア層８を介して接触している。引出し電極５は、Ｃｒ，Ａｌ，Ｃｕ，Ａｇ，Ａｕ，Ｐｔ，Ｐｄ，Ｎｉ，Ｍｏ，Ｔａ，Ｔｉ，Ｗ，Ｃ，Ｆｅ，Ｉｎ，Ａｇ－Ｍｇ，Ｚｎ等の金属導電材料で形成される。バリア層８は、耐熱変質性の良好な高融点金属，貴金属，酸化物，窒化物又は酸窒化物で形成される。



1

【特許請求の範囲】

【請求項１】 透明基板に設けられた引出し電極の表層にバリア層を形成し、有機発光層を介して透明基板上に積層された金属電極に、前記バリア層を介して前記引出し電極が接触していることを特徴とする有機エレクトロルミネッセンス表示デバイス。

【請求項２】 Ｃｒ，Ａｌ，Ｃｕ，Ａｇ，Ａｕ，Ｐｔ，Ｐｄ，Ｎｉ，Ｍｏ，Ｔａ，Ｔｉ，Ｗ，Ｃ，Ｆｅ，Ｉｎ，Ａｇ－Ｍｇ，Ｚｎから選ばれた金属質導電材料で引出し電極が形成されている請求項１記載の有機エレクトロルミネッセンス表示デバイス。

【請求項３】 耐熱変質性の良好な高融点金属，貴金属，酸化物，窒化物又は酸窒化物でバリア層が形成されている請求項１記載の有機エレクトロルミネッセンス表示デバイス。

【請求項４】 引出し電極用金属質導電材料の酸化物，窒化物又は酸窒化物の薄層としてバリア層が形成されている請求項１記載の有機エレクトロルミネッセンス表示デバイス。

【請求項５】 引出し電極用金属質導電材料の酸化物，窒化物又は酸窒化物の薄層を密着性改善層として介在させて引出し電極が透明基板上に形成されている請求項１記載の有機エレクトロルミネッセンス表示デバイス。

【請求項６】 バリア層及び密着性改善層を含む引出し電極を同じエッチング液で加工することを特徴とする有機エレクトロルミネッセンス表示デバイスの製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、電極に対する接触抵抗を低く維持し、比較的低い電圧で駆動可能な有機エレクトロルミネッセンス表示デバイスに関する。

【０００２】

【従来の技術】ブラウン管に代わるカラー表示装置として、液晶ディスプレイパネルが多方面で普及している。しかし、液晶ディスプレイパネルは、バックライトから液晶層を通過した光で画像表示する方式であるため、見る角度や周囲の明暗度によって画像が見難くなることがある。この点、面発光によって必要画像を表示するエレクトロルミネッセンス素子を用いたディスプレイパネルは、画像の見易さが観察角度によって変わることなく、暗所でも十分な鮮明度で画像が観察される。

【０００３】エレクトロルミネッセンス材料として種々の無機材料及び有機材料が知られているが、低電力で高輝度発光する有機材料が注目されている。有機発光材料を使用した表示デバイスは、透明基板１に複数のストライプ状透明電極２，有機発光層３，透明電極２に直交する複数のストライプ状金属電極４を順次積層した構造（図１）をもっている。透明基板１の上には、金属電極４に導通する引出し電極５が積層されている。

【０００４】透明電極２及び金属電極４で形成されるＸＹマトリックス上の所定位置に駆動電流を供給すると、陽極側からのホールと陰極側からの電子が有機発光層３で再結合し、有機発光体分子が励起され面状に発光する。発光は、透明電極２及び透明基板１を通して外部に取り出される。本出願人は、この有機エレクトロルミネッセンス表示デバイスにおいて層間絶縁膜６を形成するとき、透明電極２エッジ部の段差に起因する透明電極２と金属電極４との短絡が防止され、鮮明な画像が表示されることを特開平８－３１５９８１号公報で紹介した。

2

【０００５】

【発明が解決しようとする課題】層間絶縁膜６は、たとえばシリカ分散ペーストを所定パターンで塗布し、ベークによって形成される。或いは、ポリイミド系塗料を塗布して、熱処理で架橋させることにより安定なポリマー皮膜として形成される。何れの場合も、層間絶縁膜６の形成にベークを必要とし、引出し電極５の表面を変質させやすい。引出し電極５の材料としては抵抗値が低い金属が使用されているが、ベークによって表面に変質層７（図２）が生成すると、金属電極４との接触抵抗Ｒが増加する。その結果、有機エレクトロルミネッセンス表示デバイスの駆動に高い電圧が必要となり、また昇温による有機エレクトロルミネッセンス表示デバイスの劣化も促進される。

【０００６】

【課題を解決するための手段】本発明は、このような問題を解消すべく案出されたものであり、引出し電極の表面にバリア層を形成することにより、ベーク等の加熱時に引出し電極の変質、ひいては引出し電極と金属電極との接触抵抗の上昇を防止し、比較的低い電圧で駆動可能な有機エレクトロルミネッセンス表示デバイスを提供することを目的とする。本発明の有機エレクトロルミネッセンス表示デバイスは、その目的を達成するため、透明基板に設けられた引出し電極の表層にバリア層を形成し、有機発光層を介して透明基板上に積層された金属電極に、前記バリア層を介して前記引出し電極が接触していることを特徴とする。

【０００７】引出し電極は、たとえばＣｒ，Ａｌ，Ｃｕ，Ａｇ，Ａｕ，Ｐｔ，Ｐｄ，Ｎｉ，Ｍｏ，Ｔａ，Ｔｉ，Ｗ，Ｃ，Ｆｅ，Ｉｎ，Ａｇ－Ｍｇ，Ｚｎから選ばれた金属質導電材料で形成される。バリア層は、耐熱変質性の良好な高融点金属，貴金属，酸化物，窒化物又は酸窒化物で形成される。また、引出し電極用金属質導電材料の酸化物，窒化物又は酸窒化物の薄層としてもバリア層を形成できる。更に、引出し電極用金属質導電材料の酸化物，窒化物又は酸窒化物の薄層を密着性改善層として形成した後で、引出し電極を透明基板上に形成してもよい。引出し電極の表層に形成されるバリア層は、密着性改善層を含む引出し電極と共に同じエッチング液を用いて加工することができる。

【０００８】

【実施の形態】本発明に従った有機エレクトロルミネッセンス表示デバイスは、たとえば図3に示すように、引出し電極5の表面をバリア層8で被覆している。その他は、従来の有機エレクトロルミネッセンス表示デバイス（図1）とほぼ同じ層構造をもっている。バリア層8の形成によって、層間絶縁膜6形成時に引出し電極5の表面が熱的に保護され、変質層7の生成が防止される。引出し電極5の材料には、たとえば抵抗値の低いCr, Al, Cu, Ag, Au, Pt, Pd, Ni, Mo, Ta, Ti, W, C, Fe, In, Ag-Mg, Zn等の金属又は合金が使用される。これらの金属又は合金は、蒸着，スパッタリング，イオンプレーティング等の方法により薄膜として透明基板1上に形成される。

【0009】バリア層8の材料としては、層間絶縁膜6形成時のベーク等、熱処理の際に変質しない高融点金属，貴金属，酸化物，窒化物，酸窒化物等が適している。導電性を妨げない程度の膜厚（具体的には10～1000Å，好ましくは10～500Å，最適には10～200Å）でバリア層8を形成する場合、絶縁物に分類されている材料でも使用可能である。具体的には、耐変質性に優れたAu，Pt，Pd，W，Mo等の金属材料の他に、CrO_x, AlO_x, MoO_x, FeO_x, NiO_x, AgO_x, ZnO_x, TaO_x, WO_x, SiO_x, SnO_x, CrN_x, SiN_x, CrN_xO_y, TiC_x, $TaSnO_xN_y$等の酸化物，窒化物，酸窒化物等がある。

【0010】また、引出し電極5に使用する金属又は合金の酸化物，窒化物又は酸窒化物をバリア層8に使用することも可能である。この場合、たとえば引出し電極5を成膜する最終段階で、雰囲気に酸素及び／又は窒素を導入することにより金属酸化物，金属窒化物，金属酸窒化物等のバリア層8が引出し電極5上に形成される。引出し電極5と同じ金属の酸化物，窒化物又は酸窒化物で形成されたバリア層8は，引出し電極5と同じエッチング液を用いてパターニングできる場合も多い。引出し電極5の表層に形成されたバリア層8は、層間絶縁膜6を形成するベーク処理時に変質層7の生成を防止する上で有効であるが、ベーク処理時に限らず他の熱処理工程においても変質層7の生成を有効に抑制し、金属電極4に対する引出し電極5の接触抵抗を低位に維持する。

【0011】更に、引出し電極5の形成に先立って，酸素を導入したAr雰囲気でたとえばCrをスパッタリングすると、CrO_x質の薄膜が透明基板1上に形成される。CrO_x質薄膜は、基板1に対する引出し電極5の密着性を向上させる密着性改善層9（図5）として働く。CrO_x質薄膜も、引出し電極5と同じエッチング液を用いてパターニングできる。

【0012】

【実施例1】透明基板1に透明電極2を形成した後、Ar雰囲気でCrをターゲットに用いたスパッタリングによって膜厚2900Åの純Cr薄膜を形成した（図4a）。次いで、Ar雰囲気に酸素を導入し、CrO_xを引出し電極5の上に堆積させ，膜厚100ÅのCrO_x薄膜を形成した（図4b）。CrO_x薄膜が形成された後の透明基板1にレジストパターンを形成した後、硝酸セリウムアンモンを含むエッチング液を用いてエッチングし，レジストを剥離することによって純Cr薄膜及びCrO_x薄膜をパターニングして所定形状の引出し電極5及びバリア層8を形成した（図4c）。このとき、同じエッチング液で引出し電極5及びバリア層8の双方をパターニングできるため、簡便な工程で所定形状の引出し電極5及びバリア層8が作成できる。

【0013】次いで、透明基板1をオーブンに装入して150～300℃の範囲でベークした後、Alを蒸着するリフトオフ法で金属電極4を形成した（図4d）。形成された金属電極4と引出し電極5との接触抵抗Rを測定した結果を表1に示す。表1から明らかなように、CrO_xをバリア層8として形成した引出し電極5では、ベーク後にも金属電極4に対して低い接触抵抗を維持しており、ベーク温度200℃以上でほぼ一定した低接触抵抗を示した。

【0014】

【実施例2】透明基板1に対する引出し電極5の密着性を向上させるため、酸素を導入したAr雰囲気でCrをターゲットにしたスパッタリングによって膜厚100ÅのCrO_x薄膜（密着性改善層9）を透明基板1上に形成した（図5a）。次いで、酸素フリーのAr雰囲気に代えてCrをスパッタリングし、膜厚2800ÅのCr薄膜（引出し電極5）を堆積させ（図5b），再び酸素をAr雰囲気に導入してスパッタリングし、膜厚100ÅのCrO_x薄膜（バリア層8）を金属電極4の上に形成した（図5c）。各薄膜を実施例1と同じエッチング方法でパターニングし、下層に密着性改善層9，表層にバリア層8を備えた引出し電極5を形成した（図5d）。次いで、透明基板1をオーブンに装入して150～300℃の範囲でベークした後、Alを蒸着するリフトオフ法で金属電極4を形成した（図5e）。

【0015】密着性改善層9及びバリア層8のCrO_x薄膜で挟持された引出し電極5の金属電極4に対する接触抵抗Rを測定した結果を表1に示す。この場合にも、ベーク温度に拘わらず低い接触抵抗が維持された。また、基板／Cr薄膜及び基板／CrO_x薄膜／Cr薄膜を碁盤目密着試験に供して密着性を調査したところ、それぞれ75／100及び100／100の試験結果が得られ、CrO_x薄膜を介在させることによって基板1に対する引出し電極5の密着性が向上することが判った。

【0016】

【比較例】バリア層8及び密着性改善層9を形成しないことを除き、実施例1と同じ方法で引出し電極5を透明基板1の上に形成した後、金属電極4を堆積させた。形

5 6

成された引出し電極５の金属電極４に対する接触抵抗Ｒを測定したところ、表１にみられるようにベークにより接触抵抗が増加し、なかでも２５０℃を超えるベーク温度では接触抵抗の増加が著しかった。接触抵抗の著しい＊増加は、引出し電極５の表面に変質層７が生成した結果であり、駆動時に有機エレクトロルミネッセンス表示デバイスを昇温させる原因にもなる。

【００１７】

表１：Ｃｒ引出し電極の層構成及びベーク温度が金属電極との接触抵抗（Ω）に及ぼす影響

引出し電極の層構造	ベーク温度 (℃)					
	20	150	200	250	300	350
Cr／CrOx	2.8×10^{3}	3.9×10^{3}	8.6×10^{1}	2.5×10^{1}	1.7×10^{1}	8.0×10^{1}
CrOx／Cr／CrOx	2.9×10^{3}	3.3×10^{1}	8.7×10^{1}	2.5×10^{1}	1.7×10^{1}	7.9×10^{1}
バリア層なし	6.2×10^{1}	2.3×10^{2}	1.1×10^{2}	6.3×10^{2}	4.8×10^{3}	2.8×10^{5}

【００１８】

【発明の効果】以上に説明したように、本発明の有機エレクトロルミネッセンス表示デバイスは、透明基板の上に設けられる引出し電極の表層にバリア層を形成しているので、層間絶縁膜形成時等の際に加熱されても引出し電極の表面に変質層が生じることがない。したがって、引出し電極と金属電極との接触抵抗が低く維持され、比較的低い電圧で駆動することが可能な有機エレクトロルミネッセンス表示デバイスとなる。また、密着性改善層を介して引出し電極を形成するとき、透明基板に対する引出し電極の密着性が向上し、引出し電極と金属電極との良好な導通状態が維持される。

【図面の簡単な説明】

【図１】　層間絶縁膜を設けた有機エレクトロルミネッ※センス表示デバイスの層構造を示す断面図

【図２】　引出し電極の表面に生成した変質層により接触抵抗が上昇することを説明する図

【図３】　本発明に従ってバリア層を形成した有機エレクトロルミネッセンス表示デバイスの層構造を示す断面図

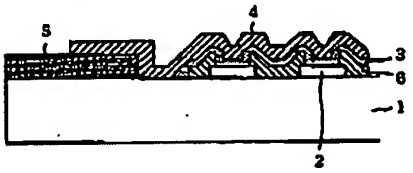
【図４】　実施例１の有機エレクトロルミネッセンス表示デバイスを作製する工程図

【図５】　実施例２の有機エレクトロルミネッセンス表示デバイスを作製する工程図

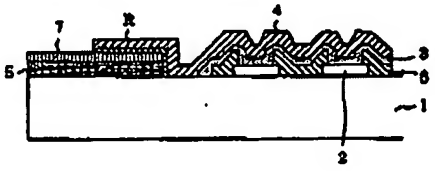
【符号の説明】

１：透明基板　２：透明電極　３：有機発光層
４：金属電極　５：引出し電極　６：層間絶縁膜
７：変質層　８：バリア層　９：密着性改善層

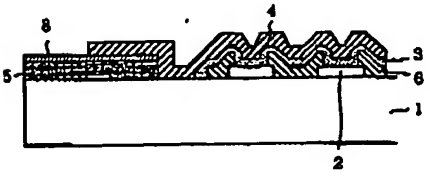
【図１】



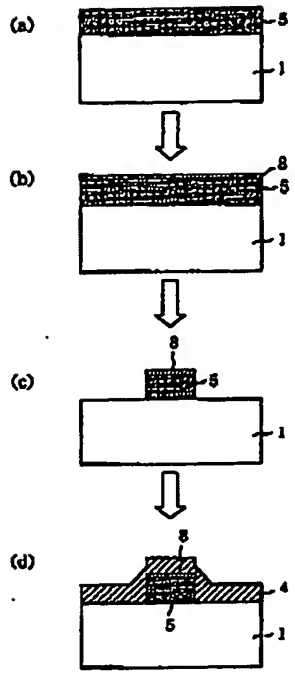
【図２】



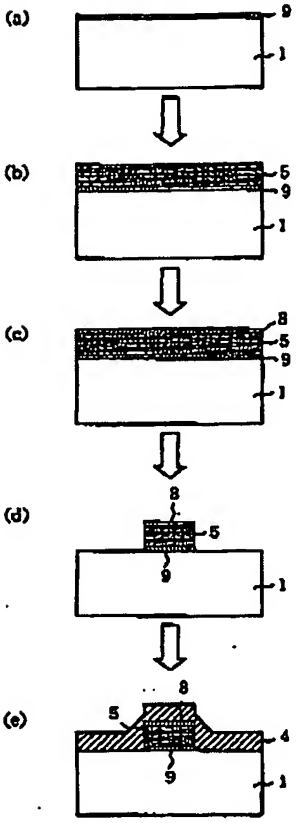
【図３】



【図4】



【図5】



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention maintains the contact resistance to an electrode low, and relates to the organic electroluminescence display device which can be driven on a comparatively low electrical potential difference.
[0002]
[Description of the Prior Art] As a electrochromatic display which replaces the Braun tube, a liquid crystal display panel is various and has spread. However, since a liquid crystal display panel is a method which carries out image display with the light which passed the liquid crystal layer from the back light, an image may become hard to see with the include angle to see or surrounding intensity. An image is observed by visibility sufficient also in a dark place, without the display panel using this point and the electroluminescent element which displays a need image by field luminescence changing the conspicuousness of an image with an observation include angle.
[0003] Although various inorganic materials and organic materials are known as an electroluminescence ingredient, the organic material which carries out high brightness luminescence with low power attracts attention. the structure (drawing 1) to which the display device which used an organic luminescent material carried out the laminating of two or more stripe-like metal electrodes 4 which intersect perpendicularly with two or more stripe-like transparent electrodes 2, the organic luminous layer 3, and a transparent electrode 2 to the transparence substrate 1 one by one -- **** -- it is. On the transparence substrate 1, the laminating of the cash-drawer electrode 5 which flows in a metal electrode 4 is carried out.
[0004] If a drive current is supplied to the predetermined location on XY matrix formed with a transparent electrode 2 and a metal electrode 4, the electron from the hole side from an anode plate side and a cathode side will recombine by the organic luminous layer 3, an organic emitter molecule will be excited, and light will be emitted in the shape of a field. Luminescence is taken out outside through a transparent electrode 2 and the transparence substrate 1. The short circuit of the transparent electrode 2 and metal electrode 4 resulting from the level difference of the transparent electrode 2 edge section was prevented, and these people introduced by JP,8-315981,A that a clear image was displayed, when forming an interlayer insulation film 6 in this organic electroluminescence display device.
[0005]
[Problem(s) to be Solved by the Invention] An interlayer insulation film 6 applies for example, a silica distribution paste by the predetermined pattern, and is formed of BEKU. Or a polyimide system coating is applied and it is formed as a stable polymer coat by making a bridge construct by heat treatment. In any case, BEKU is needed for formation of an interlayer insulation film 6, and it is easy to deteriorate the front face of the cash-drawer electrode 5. Although the metal with resistance low as an ingredient of the cash-drawer electrode 5 is used, if the deterioration layer 7 (drawing 2) generates on a front face by BEKU, the contact resistance R with a metal electrode 4 will increase. Consequently, a high electrical potential difference is needed for the drive of an organic electroluminescence display device, and degradation of the organic electroluminescence display device by the temperature up is also promoted.
[0006]
[Means for Solving the Problem] By being thought out that such a problem should be solved and forming a barrier layer in the front face of a cash-drawer electrode, this invention is pulled out at the time of heating of BEKU etc., prevents deterioration of an electrode, as a result the rise of the contact resistance of a cash-drawer electrode and a metal electrode, and aims at offering the organic electroluminescence display device which can be driven on a comparatively low electrical potential difference. It pulls out, a barrier layer is formed in the surface of an electrode, and the organic electroluminescence display device of this invention is characterized by said cash-drawer electrode touching the metal electrode which was prepared in the transparence substrate and by which the laminating was carried out on the transparence substrate through the organic luminous layer through said barrier layer in order to attain the purpose.
[0007] A cash-drawer electrode is formed with the nature electrical conducting material of a metal chosen from Cr, aluminum, Cu, Ag, Au, Pt, Pd, nickel, Mo, Ta, Ti, W, C, Fe, In, Ag-Mg, and Zn. A barrier layer is formed with the good refractory metal, the noble metals, the oxide, nitride, or acid nitride of heat-resistant deterioration nature. Moreover, a barrier layer can be formed also as a thin layer of the

oxide of the nature electrical conducting material for cash-drawer electrodes of a metal, a nitride, or an acid nitride. Furthermore, after forming the thin layer of the oxide of the nature electrical conducting material for cash-drawer electrodes of a metal, a nitride, or an acid nitride as an adhesion improvement layer, a cash-drawer electrode may be formed on a transparence substrate. The barrier layer formed in the surface of a cash-drawer electrode is processible using the same etching reagent with the cash-drawer electrode containing an adhesion improvement layer.

[0008]

[Embodiment of the Invention] The organic electroluminescence display device according to this invention has covered the front face of the cash-drawer electrode 5 with the barrier layer 8, as shown in drawing 3 . Others have the almost same layer structure as the conventional organic electroluminescence display device (drawing 1). By formation of the barrier layer 8, it pulls out at the time of interlayer insulation film 6 formation; the front face of an electrode 5 is protected thermally, and generation of the deterioration layer 7 is prevented. A metal or alloys, such as Cr, aluminum, Cu, Ag, Au, Pt, Pd, nickel, Mo, Ta, Ti, W, C, Fe, and In, with low resistance, Ag-Mg, and Zn, are used for the ingredient of the cash-drawer electrode 5. These metals or alloys are formed on the transparence substrate 1 as a thin film by approaches, such as vacuum evaporationo, sputtering, and ion plating.

[0009] As an ingredient of the barrier layer 8, the refractory metal which does not deteriorate in the case of heat treatments, such as BEKU at the time of interlayer insulation film 6 formation, noble metals, the oxide, the nitride, the acid nitride, etc. are suitable. When forming the barrier layer 8 by the thickness (specifically 10-100A, preferably 10-500A, the optimal 10-200A) of extent which does not bar conductivity, the ingredient classified into the insulating material is also usable. Specifically, there are oxides, such as CrOx, AlOx, MoOx, FeOx, NiOx, AgOx, ZnOx, TaOx, WOx, SiOx, SnOx, CrNx, SiNx, CrNxOy, TiCx, TaSnOx, and TaSnOxNy, a nitride, an acid nitride, etc. other than metallic materials, such as Au, Pt, Pd, W, Mo, etc. excellent in deterioration-proof nature.

[0010] Moreover, it is also possible to use the metal used for the cash-drawer electrode 5 or the oxide of an alloy, a nitride, or an acid nitride for the barrier layer 8. In the culmination which forms the cash-drawer electrode 5 in this case, by introducing oxygen and/or nitrogen into an ambient atmosphere, the barrier layers 8, such as a metallic oxide, a metal nitride, and a metal acid nitride, pull out, and it is formed on an electrode 5. The barrier layer 8 formed with the oxide, nitride, or acid nitride of the same metal as the cash-drawer electrode 5 can carry out patterning using the same etching reagent as the cash-drawer electrode 5 in many cases. Although the barrier layer 8 formed in the surface of the cash-drawer electrode 5 is effective when preventing generation of the deterioration layer 7 at the time of the BEKU processing which forms an interlayer insulation film 6, also not only in the time of BEKU processing but in other heat treatment processes, generation of the deterioration layer 7 is controlled effectively, and the contact resistance of the cash-drawer electrode 5 to a metal electrode 4 is maintained to lower order.

[0011] Furthermore, if sputtering of the Cr is carried out in advance of formation of the cash-drawer electrode 5 in Ar ambient atmosphere which introduced oxygen, the thin film of the quality of CrOx will be formed on the transparence substrate 1. The nature thin film of CrOx works as an adhesion improvement layer 9 (drawing 5) which raises the adhesion of the cash-drawer electrode 5 to a substrate 1. Patterning also of the nature thin film of CrOx can be carried out using the same etching reagent as the cash-drawer electrode 5.

[0012]

[Example 1] After forming a transparent electrode 2 in the transparence substrate 1, the pure Cr thin film of 2900A of thickness was formed by sputtering which used Cr for the target in Ar ambient atmosphere (drawing 4 a). Subsequently, introduced oxygen into Ar ambient atmosphere, and pulled out CrOx, it was made to deposit on an electrode 5, and the CrOx thin film of 100A of thickness was formed (drawing 4 b). It etched into the transparence substrate 1 after the CrOx thin film was formed using the etching reagent which contains cerium-nitrate Amon after forming a resist pattern, and by exfoliating a resist, patterning of a pure Cr thin film and the CrOx thin film was carried out, and the cash-drawer electrode 5 and the barrier layer 8 of a predetermined configuration were formed (drawing 4 c). Since the same etching reagent draws out and patterning of the both sides of an electrode 5 and the barrier layer 8 can be carried out at this time, the cash-drawer electrode 5 and the barrier layer 8 of a predetermined configuration can be created at a simple process.

[0013] Subsequently, after BEKU [inserting the transparence substrate 1 in oven and] in 150-300 degrees C, the metal electrode 4 was formed by the lift-off method which vapor-deposits aluminum (drawing 4 d). The result of having pulled out with the formed metal electrode 4 and having measured

the contact resistance R with an electrode 5 is shown in Table 1. The low contact resistance which formed CrOx as a barrier layer 8 and which pulled out, was maintaining low contact resistance to the metal electrode 4 in the electrode 5 also after BEKU, and was mostly fixed with the baking temperature of 200 degrees C or more was shown so that clearly from Table 1.

[0014]

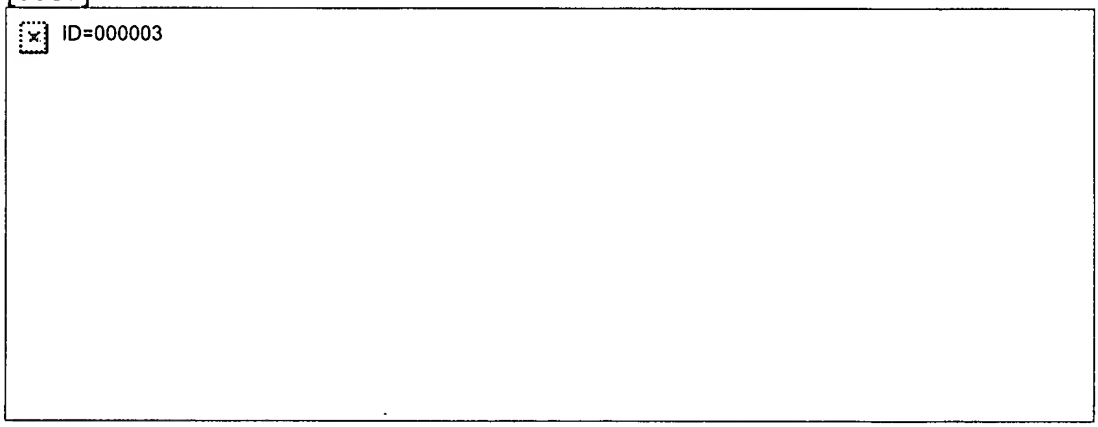
[Example 2] In order to raise the adhesion of the cash-drawer electrode 5 to the transparence substrate 1, the CrOx thin film (adhesion improvement layer 9) of 100A of thickness was formed on the transparence substrate 1 by sputtering which targeted Cr in Ar ambient atmosphere which introduced oxygen (drawing 5 a). subsequently, oxygen -- it replaced with free Ar ambient atmosphere, and sputtering of the Cr was carried out, Cr thin film (cash-drawer electrode 5) of 2800A of thickness was made to deposit (drawing 5 b), sputtering of the oxygen was again introduced and carried out to Ar ambient atmosphere, and the CrOx thin film (barrier layer 8) of 100A of thickness was formed on the metal electrode 4 (drawing 5 c). Patterning of each thin film was carried out by the same etching approach as an example 1, and the cash-drawer electrode 5 which equipped the lower layer with the adhesion improvement layer 9, and equipped the surface with the barrier layer 8 was formed (drawing 5 d). Subsequently, after BEKU [inserting the transparence substrate 1 in oven and] in 150-300 degrees C, the metal electrode 4 was formed by the lift-off method which vapor-deposits aluminum (drawing 5 e).

[0015] The result of having pulled out and having measured the contact resistance R to the metal electrode 4 of an electrode 5 pinched with the CrOx thin film of the adhesion improvement layer 9 and the barrier layer 8 is shown in Table 1. Also in this case, low contact resistance was maintained irrespective of baking temperature. Moreover, when the squares adherence test was presented with the substrate / Cr thin film, and the substrate / CrOx thin film / Cr thin film and adhesion was investigated, the test result of 75/100 and 100/100 was obtained, respectively, and by making a CrOx thin film intervene showed that the adhesion of the cash-drawer electrode 5 to a substrate 1 improved.

[0016]

[Comparative Example(s)] After pulling out by the same approach as an example 1 and forming an electrode 5 on the transparence substrate 1 except for not forming the barrier layer 8 and the adhesion improvement layer 9, the metal electrode 4 was made to deposit. When it pulled out and the formed contact resistance R to the metal electrode 4 of an electrode 5 was measured, in the baking temperature which contact resistance increases by BEKU so that it may see in Table 1, and exceeds 250 degrees C especially, the increment in contact resistance was remarkable. The remarkable increment in contact resistance is the result of the deterioration layer 7 generating on the front face of the cash-drawer electrode 5, and also becomes the cause to which the temperature up of the organic electroluminescence display device is carried out at the time of a drive.

[0017]



[0018]

[Effect of the Invention] As explained above, since the organic electroluminescence display device of this invention forms the barrier layer in the surface of the cash-drawer electrode prepared on a transparence substrate, even if it is heated in the cases at the time of interlayer insulation film formation etc., it is pulled out, and a deterioration layer does not produce it on the surface of an electrode. Therefore, the contact resistance of a cash-drawer electrode and a metal electrode is maintained low, and it becomes the organic electroluminescence display device which can be driven on a comparatively low

electrical potential difference. Moreover, when pulling out through an adhesion improvement layer and forming an electrode, the adhesion of the cash-drawer electrode to a transparence substrate improves, and the good switch-on of a cash-drawer electrode and a metal electrode is maintained.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention maintains the contact resistance to an electrode low, and relates to the organic electroluminescence display device which can be driven on a comparatively low electrical potential difference.
[0002]
[Description of the Prior Art] As a electrochromatic display which replaces the Braun tube, a liquid crystal display panel is various and has spread. However, since a liquid crystal display panel is a method which carries out image display with the light which passed the liquid crystal layer from the back light, an image may become hard to see with the include angle to see or surrounding intensity. An image is observed by visibility sufficient also in a dark place, without the display panel using this point and the electroluminescent element which displays a need image by field luminescence changing the conspicuousness of an image with an observation include angle.
[0003] Although various inorganic materials and organic materials are known as an electroluminescence ingredient, the organic material which carries out high brightness luminescence with low power attracts attention. the structure (drawing 1) to which the display device which used an organic luminescent material carried out the laminating of two or more stripe-like metal electrodes 4 which intersect perpendicularly with two or more stripe-like transparent electrodes 2, the organic luminous layer 3, and a transparent electrode 2 to the transparence substrate 1 one by one -- **** -- it is. On the transparence substrate 1, the laminating of the cash-drawer electrode 5 which flows in a metal electrode 4 is carried out.
[0004] If a drive current is supplied to the predetermined location on XY matrix formed with a transparent electrode 2 and a metal electrode 4, the electron from the hole side from an anode plate side and a cathode side will recombine by the organic luminous layer 3, an organic emitter molecule will be excited, and light will be emitted in the shape of a field. Luminescence is taken out outside through a transparent electrode 2 and the transparence substrate 1. The short circuit of the transparent electrode 2 and metal electrode 4 resulting from the level difference of the transparent electrode 2 edge section was prevented, and these people introduced by JP,8-315981,A that a clear image was displayed, when forming an interlayer insulation film 6 in this organic electroluminescence display device.
[0005]
[Problem(s) to be Solved by the Invention] An interlayer insulation film 6 applies for example, a silica distribution paste by the predetermined pattern, and is formed of BEKU. Or a polyimide system coating is applied and it is formed as a stable polymer coat by making a bridge construct by heat treatment. In any case, BEKU is needed for formation of an interlayer insulation film 6, and it is easy to deteriorate the front face of the cash-drawer electrode 5. Although the metal with resistance low as an ingredient of the cash-drawer electrode 5 is used, if the deterioration layer 7 (drawing 2) generates on a front face by BEKU, the contact resistance R with a metal electrode 4 will increase. Consequently, a high electrical potential difference is needed for the drive of an organic electroluminescence display device, and degradation of the organic electroluminescence display device by the temperature up is also promoted.
[0006]
[Means for Solving the Problem] By being thought out that such a problem should be solved and forming a barrier layer in the front face of a cash-drawer electrode, this invention is pulled out at the time of heating of BEKU etc., prevents deterioration of an electrode, as a result the rise of the contact resistance of a cash-drawer electrode and a metal electrode, and aims at offering the organic electroluminescence display device which can be driven on a comparatively low electrical potential difference. It pulls out, a barrier layer is formed in the surface of an electrode, and the organic electroluminescence display device of this invention is characterized by said cash-drawer electrode touching the metal electrode which was prepared in the transparence substrate and by which the laminating was carried out on the transparence substrate through the organic luminous layer through said barrier layer in order to attain the purpose.
[0007] A cash-drawer electrode is formed with the nature electrical conducting material of a metal chosen from Cr, aluminum, Cu, Ag, Au, Pt, Pd, nickel, Mo, Ta, Ti, W, C, Fe, In, Ag-Mg, and Zn. A barrier layer is formed with the good refractory metal, the noble metals, the oxide, nitride, or acid nitride of heat-resistant deterioration nature. Moreover, a barrier layer can be formed also as a thin layer of the

oxide of the nature electrical conducting material for cash-drawer electrodes of a metal, a nitride, or an acid nitride. Furthermore, after forming the thin layer of the oxide of the nature electrical conducting material for cash-drawer electrodes of a metal, a nitride, or an acid nitride as an adhesion improvement layer, a cash-drawer electrode may be formed on a transparence substrate. The barrier layer formed in the surface of a cash-drawer electrode is processible using the same etching reagent with the cash-drawer electrode containing an adhesion improvement layer.

[0008]

[Embodiment of the Invention] The organic electroluminescence display device according to this invention has covered the front face of the cash-drawer electrode 5 with the barrier layer 8, as shown in drawing 3 . Others have the almost same layer structure as the conventional organic electroluminescence display device (drawing 1). By formation of the barrier layer 8, it pulls out at the time of interlayer insulation film 6 formation, the front face of an electrode 5 is protected thermally, and generation of the deterioration layer 7 is prevented. A metal or alloys, such as Cr, aluminum, Cu, Ag, Au, Pt, Pd, nickel, Mo, Ta, Ti, W, C, Fe and In with low resistance, Ag-Mg, and Zn, are used for the ingredient of the cash-drawer electrode 5. These metals or alloys are formed on the transparence substrate 1 as a thin film by approaches, such as vacuum evaporationo, sputtering, and ion plating.

[0009] As an ingredient of the barrier layer 8, the refractory metal which does not deteriorate in the case of heat treatments, such as BEKU at the time of interlayer insulation film 6 formation, noble metals, the oxide, the nitride, the acid nitride, etc. are suitable. When forming the barrier layer 8 by the thickness (specifically 10-100A, preferably 10-500A, the optimal 10-200A) of extent which does not bar conductivity, the ingredient classified into the insulating material is also usable. Specifically, there are oxides, such as CrOx, AlOx, MoOx, FeOx, NiOx, AgOx, ZnOx, TaOx, WOx, SiOx, SnOx, CrNx, SiNx, CrNxOy, TiCx, TaSnOx, and TaSnOxNy, a nitride, an acid nitride, etc. other than metallic materials, such as Au, Pt, Pd, W, Mo, etc. excellent in deterioration-proof nature.

[0010] Moreover, it is also possible to use the metal used for the cash-drawer electrode 5 or the oxide of an alloy, a nitride, or an acid nitride for the barrier layer 8. In the culmination which forms the cash-drawer electrode 5 in this case, by introducing oxygen and/or nitrogen into an ambient atmosphere, the barrier layers 8, such as a metallic oxide, a metal nitride, and a metal acid nitride, pull out, and it is formed on an electrode 5. The barrier layer 8 formed with the oxide, nitride, or acid nitride of the same metal as the cash-drawer electrode 5 can carry out patterning using the same etching reagent as the cash-drawer electrode 5 in many cases. Although the barrier layer 8 formed in the surface of the cash-drawer electrode 5 is effective when preventing generation of the deterioration layer 7 at the time of the BEKU processing which forms an interlayer insulation film 6, also not only in the time of BEKU processing but in other heat treatment processes, generation of the deterioration layer 7 is controlled effectively, and the contact resistance of the cash-drawer electrode 5 to a metal electrode 4 is maintained to lower order.

[0011] Furthermore, if sputtering of the Cr is carried out in advance of formation of the cash-drawer electrode 5 in Ar ambient atmosphere which introduced oxygen, the thin film of the quality of CrOx will be formed on the transparence substrate 1. The nature thin film of CrOx works as an adhesion improvement layer 9 (drawing 5) which raises the adhesion of the cash-drawer electrode 5 to a substrate 1. Patterning also of the nature thin film of CrOx can be carried out using the same etching reagent as the cash-drawer electrode 5.

[0012]

[Example 1] After forming a transparent electrode 2 in the transparence substrate 1, the pure Cr thin film of 2900A of thickness was formed by sputtering which used Cr for the target in Ar ambient atmosphere (drawing 4 a). Subsequently, introduced oxygen into Ar ambient atmosphere, and pulled out CrOx, it was made to deposit on an electrode 5, and the CrOx thin film of 100A of thickness was formed (drawing 4 b). It etched into the transparence substrate 1 after the CrOx thin film was formed using the etching reagent which contains cerium-nitrate Amon after forming a resist pattern, and by exfoliating a resist, patterning of a pure Cr thin film and the CrOx thin film was carried out, and the cash-drawer electrode 5 and the barrier layer 8 of a predetermined configuration were formed (drawing 4 c). Since the same etching reagent draws out and patterning of the both sides of an electrode 5 and the barrier layer 8 can be carried out at this time, the cash-drawer electrode 5 and the barrier layer 8 of a predetermined configuration can be created at a simple process.

[0013] Subsequently, after BEKU [inserting the transparence substrate 1 in oven and] in 150-300 degrees C, the metal electrode 4 was formed by the lift-off method which vapor-deposits aluminum (drawing 4 d). The result of having pulled out with the formed metal electrode 4 and having measured

the contact resistance R with an electrode 5 is shown in Table 1. The low contact resistance which formed CrOx as a barrier layer 8 and which pulled out, was maintaining low contact resistance to the metal electrode 4 in the electrode 5 also after BEKU, and was mostly fixed with the baking temperature of 200 degrees C or more was shown so that clearly from Table 1.

[0014]

[Example 2] In order to raise the adhesion of the cash-drawer electrode 5 to the transparence substrate 1, the CrOx thin film (adhesion improvement layer 9) of 100A of thickness was formed on the transparence substrate 1 by sputtering which targeted Cr in Ar ambient atmosphere which introduced oxygen (drawing 5 a). subsequently, oxygen -- it replaced with free Ar ambient atmosphere, and sputtering of the Cr was carried out, Cr thin film (cash-drawer electrode 5) of 2800A of thickness was made to deposit (drawing 5 b), sputtering of the oxygen was again introduced and carried out to Ar ambient atmosphere, and the CrOx thin film (barrier layer 8) of 100A of thickness was formed on the metal electrode 4 (drawing 5 c). Patterning of each thin film was carried out by the same etching approach as an example 1, and the cash-drawer electrode 5 which equipped the lower layer with the adhesion improvement layer 9, and equipped the surface with the barrier layer 8 was formed (drawing 5 d). Subsequently, after BEKU [inserting the transparence substrate 1 in oven and] in 150-300 degrees C, the metal electrode 4 was formed by the lift-off method which vapor-deposits aluminum (drawing 5 e).

[0015] The result of having pulled out and having measured the contact resistance R to the metal electrode 4 of an electrode 5 pinched with the CrOx thin film of the adhesion improvement layer 9 and the barrier layer 8 is shown in Table 1. Also in this case, low contact resistance was maintained irrespective of baking temperature. Moreover, when the squares adherence test was presented with the substrate / Cr thin film, and the substrate / CrOx thin film / Cr thin film and adhesion was investigated, the test result of 75/100 and 100/100 was obtained, respectively, and by making a CrOx thin film intervene showed that the adhesion of the cash-drawer electrode 5 to a substrate 1 improved.

[0016]

[Comparative Example(s)] After pulling out by the same approach as an example 1 and forming an electrode 5 on the transparence substrate 1 except for not forming the barrier layer 8 and the adhesion improvement layer 9, the metal electrode 4 was made to deposit. When it pulled out and the formed contact resistance R to the metal electrode 4 of an electrode 5 was measured, in the baking temperature which contact resistance increases by BEKU so that it may see in Table 1, and exceeds 250 degrees C especially, the increment in contact resistance was remarkable. The remarkable increment in contact resistance is the result of the deterioration layer 7 generating on the front face of the cash-drawer electrode 5, and also becomes the cause to which the temperature up of the organic electroluminescence display device is carried out at the time of a drive.

[0017]

表１：Ｃｒ引出し電極の層構成及びベーク温度が金属電極との接触抵抗（Ω）に及ぼす影響

引出し電極の層構造	ベーク温度 (℃)					
	20	150	200	250	300	350
Cr／CrOx	2.8×10^{3}	3.9×10^{3}	8.6×10^{1}	2.5×10^{1}	1.7×10^{1}	8.0×10^{1}
CrOx／Cr／CrOx	2.9×10^{3}	3.3×10^{1}	8.7×10^{1}	2.5×10^{1}	1.7×10^{1}	7.9×10^{1}
バリア層なし	6.2×10^{1}	2.3×10^{2}	1.1×10^{2}	6.3×10^{2}	4.8×10^{3}	2.8×10^{5}

[0018]

[Effect of the Invention] As explained above, since the organic electroluminescence display device of this invention forms the barrier layer in the surface of the cash-drawer electrode prepared on a transparence substrate, even if it is heated in the cases at the time of interlayer insulation film formation etc., it is pulled out, and a deterioration layer does not produce it on the surface of an electrode. Therefore, the contact resistance of a cash-drawer electrode and a metal electrode is maintained low, and it becomes the organic electroluminescence display device which can be driven on a comparatively low

electrical potential difference. Moreover, when pulling out through an adhesion improvement layer and forming an electrode, the adhesion of the cash-drawer electrode to a transparence substrate improves, and the good switch-on of a cash-drawer electrode and a metal electrode is maintained.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the layer structure of the organic electroluminescence display device which prepared the interlayer insulation film

[Drawing 2] Drawing explaining contact resistance going up by the deterioration layer generated on the front face of a cash-drawer electrode

[Drawing 3] The sectional view showing the layer structure of the organic electroluminescence display device which formed the barrier layer according to this invention

[Drawing 4] Process drawing which produces the organic electroluminescence display device of an example 1

[Drawing 5] Process drawing which produces the organic electroluminescence display device of an example 2

[Description of Notations]

1: Transparence substrate 2: Transparent electrode 3: Organic luminous layer 4: Metal electrode 5: Cash-drawer electrode 6: Interlayer insulation film 7: Deterioration layer 8: Barrier layer 9: Adhesion improvement layer